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## Switch Amplifier with Line Fault Transparency

### Comprehensive line fault detection in process technology

**Intrinsically safe circuits for signal connection in hazardous areas are state-of-the-art technology – whether analog or digital. However, monitoring connection cables is a completely different situation. Previously, the implementation of a monitoring system for digital transfers was costly. Switch amplifiers with line fault transparency developed by Pepperl+Fuchs not only reduce the amount of wiring required, they also allow the comprehensive monitoring of field and control lines and the transfer of switch signals on each individual channel.**

In order to reduce the risk of a gas or dust explosion in process plants, the electrical components must meet the minimum ignition protection class for intrinsic safety. This specification limits the electrical energy in the entire circuit to a value below the minimum ignition energy present within the hazardous atmosphere, both during normal operation and when a malfunction occurs. This includes components that are not located in the hazardous area and are intended to reduce the energy input. Components that form an isolated barrier between the field and the PLC include switch amplifiers, supply devices and signal converters.

Within this context, one important safety aspect is the detection of line faults on the connection cables between the field device and intrinsic safety barrier. In process automation, field cables are continuously exposed to harsh environmental conditions and mechanical loads. While a system for monitoring analog signals is easy to implement due to the universal 4...20 mA technology, additional wiring has always been a basic requirement for equivalent systems used to monitor digital signals.

### Detecting and monitoring digital signals simultaneously

The NAMUR signal from a digital sensor can also transmit line faults in addition to 0 and 1 levels. Current switch amplifiers offer two options to evaluate the line fault detection system.

The first option is signaling field line faults at the signal output by deactivating the output transistor or contact (signal output in Fig. 1). The entire system switches to safe “power down” mode. The disadvantage is that it is impossible to distinguish between switching states and error states in the control because 0 signals and line faults are assigned to the same signal level.

The second option is to use an additional signal output (output ERR in Fig. 1), where the first output transfers the switching signal and the second output transfers the error signal. However, a distinction cannot be made here between line faults and switching signals sent from the switching amplifier to the control. Consequently, a distinction cannot be made between a short circuit from the control to the process control system and a 1 signal, for example. Furthermore, the amount of wiring and number of inputs in the control doubles because of the additional fault signaling output (ERR).

### **A practical solution**

Switching amplifiers with line fault transparency (LFT) developed by Pepperl+Fuchs are an extremely practical solution because they simultaneously transfer switching and error signals from the hazardous area to the control level via a single output. The trick behind this electronic development is a resistive switching output in the isolated barrier that transfers line breakage and short circuit error signals from the input circuit together with the sensor signal, even though it is isolated. When a fault occurs, the output switches to high impedance and the control system recognizes it as a line fault and evaluates it accordingly (Fig. 2). One requirement is the integration of a digital input with line fault detection in controls, which are available from all major manufacturers of process control systems.

A switching amplifier with line fault transparency offers many benefits: Apart from the switching signals, the cable on both the field and the control line are monitored continuously – on every individual channel. The costs for all the necessary wiring and the digital inputs on the control are reduced as well.

The KFD2-SOT2-Ex1.N switch amplifier from Pepperl+Fuchs' K-System (Fig. 3) is equipped with this resistive output. The comprehensive assortment of intrinsically safe isolator modules includes approximately 150 different models designed for DIN rail mounting (35 mm) – ranging from simple isolators to highly functional modules. The switch amplifier was developed specially for NAMUR sensors (EN 60947-5-6) and intrinsically safe applications up to SIL2 (IEC 61508). The error is signaled via a front-end LED according to NAMUR NE44 and a separate output. It is also possible to send a collective message via the power supply (power rail).

## Line fault transparency for the H system

The H-System was devised for multichannel applications in hazardous areas where a further reduction in wiring is required. Instead of being mounted on a DIN rail, this system uses a termination board either with terminal blocks or a control system connector that form an interface between the field devices and the process control system. The recently developed HiC2831/2 amplifiers (one/two channels) with line fault transparency are only 12.5 mm wide and compatible with existing switch amplifiers. It is also suitable for NAMUR sensors and intrinsically safe applications up to SIL2. The HiC2851 switch amplifier provides a similar solution for SIL3 signal loops.

## About Pepperl+Fuchs

Pepperl+Fuchs is a leading developer and manufacturer of electronic sensors and components for the global automation market. For more than 60 years, our continuous innovation, high quality products, and steady growth has guaranteed us continued success.

## One Company – Two Divisions

### Pepperl+Fuchs – PROTECTING YOUR PROCESS

The **Process Automation Division** is a market leader in intrinsically safe explosion protection. We offer comprehensive, application-oriented system solutions, including customer-specific control cabinet solutions for the process industry. A large portfolio of components is available from our various product lines: isolated barriers, fieldbus infrastructure solutions, remote I/O systems, HART interface solutions, level measurement devices, purge and pressurization systems, industrial monitors and HMI solutions, power supplies, separator alarm systems for oil and petrol separators, signaling equipment, lighting as well as emergency shutdown equipment and accessories.

### Pepperl+Fuchs – SENSING YOUR NEEDS

With the invention of the inductive proximity sensor in 1958, the company set an important milestone in the development of automation technology. Under the motto “Sensing your needs”, customers benefit from tailor-made sensor solutions for **factory automation**. The main target markets of the factory automation are machine and plant construction, the automotive industry, storage and material handling, printing and paper industry, packaging technology, process equipment, door, gate and elevator construction, mobile equipment, renewable energies.

The division offers a wide product range of industrial sensors whether it's inductive, photoelectric or ultrasonic sensors, rotary encoders, identification systems, barcodes, code readers for data-matrix-codes and vision sensors.

Key words: Line fault transparency, Switch amplifier, H-System, K-System, Pepperl+Fuchs

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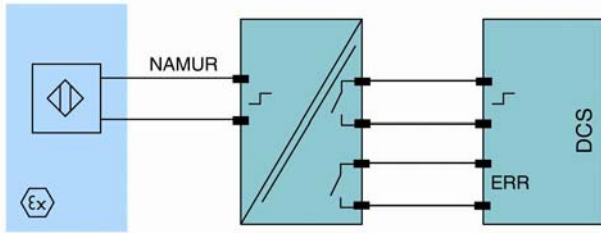
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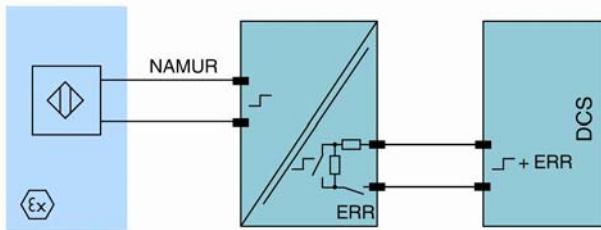
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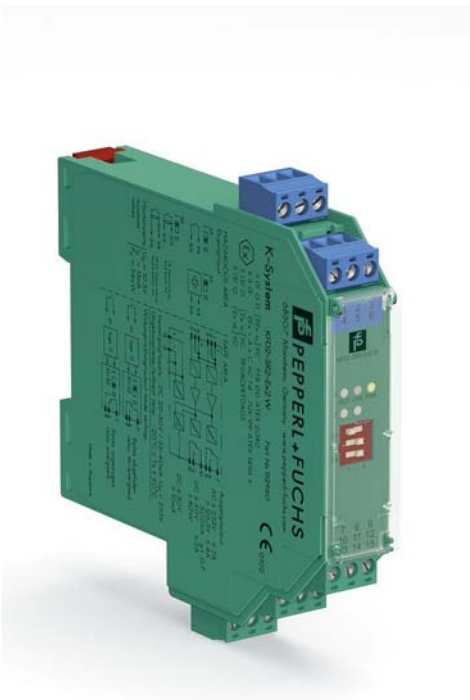
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**Fig. 1:** Previously, large amounts of wiring were needed to detect the digital output signal from the sensor and the error signal for each individual channel.



**Fig. 2:** Switch amplifiers with line fault transparency enable the comprehensive monitoring of each individual channel on field and control lines, reducing wiring requirements by up to 50%.



**Fig. 3:** Switch amplifier KFD2-SOT2-Ex1.N with line fault transparency in the K system.